

CONTINUOUS AUTOMATIC LIQUID SAMPLER

This invention concerns an apparatus designed to take an average sample of a flowing fluid.

Existing sampling systems usually function intermittently, and although the rate of sampling can be adjusted, it is not linked to the flow-rate of effluent to be sampled. A few continuous apparatuses exist but they use sampling systems in direct contact with the effluent, and are thus polluted by it, affecting the representative nature of the sample. The disadvantage of mechanical lifting devices using scoops, paddle wheels or Archimedes' screws is that they disturb the sample and could encourage segregation.

The present invention overcomes these drawbacks, ensuring an average sample representing all of the fluid flowing past a given point within a given period without agitating the sample in any way, and without any contact between the fluid and the sampling system, thus removing the possibility of any residual pollution resulting from previous sampling operations and allowing the volume of samples and duration of sampling to be modified considerably, the samples to be kept at a particular temperature, and preventing any alteration in the sample by the addition or removal of fluid by a siphoning effect.

This apparatus to take continuous average samples of a flowing fluid comprises, on the one hand a number of bottles, initially filled with an auxiliary fluid, the density of which is lower than the fluid to be sampled, which will not mix with it or affect it in any way, and which occupies the upper part of each bottle during the filling operation. The upper part of each bottle is connected by a tube, ending above the maximum upper level to which the bottle is filled, to a suction pump with an adjustable uniform flow-rate, through an electro-valve controlled by a programmed clock. Each bottle is also connected by a siphon tube, ending at a point near the bottom of the bottle, to a container holding the fluid to be sampled. The container is fed by a pump with a uniform flow rate, which removes fluid from the channel through which it flows, and is continuously emptied back into this channel, downstream of the sampling point, through an overflow spout. Means are provided for subordinating the motor driving the suction pump to the readings of a flowmeter in the channel.

In one preferred embodiment, the tube conveying the sample of fluid from the central container to each bottle contains an aperture located above the maximum upper level reached by the sample of fluid.

According to another feature, each bottle is connected to the suction pump, through a separate electro-valve, and by a siphon tube to the container holding the fluid to be sampled.

According to another feature, samples can be collected in several bottles at once, by programmed simultaneous operation of the electro-valves connected to each of them.

It will be easier to understand the invention from the following description of one embodiment, illustrated by the accompanying drawings, wherein

FIG. 1 is a schematic illustration of a sampling system in accordance with the invention; and

FIG. 2 is a top view of a portion of a preferred embodiment of the invention.

An apparatus such as the one shown in FIG. 1 contains a series of bottles (e.g. 1 and 2), placed for convenience in one or more concentric circles on a base (not shown here).

In the centre of the circle or circles is a container 3, which is fed at a uniform rate by a pump 4 with fluid drawn from a point 5 in the channel 6 containing the fluid to be sampled. Container 3 has an overflow pipe 7, which discharges the fluid back into the channel, downstream of the sampling point.

Each of bottles is hermetically sealed with a stopper 8, through which passes a filling tube 9, consisting of an upturned U-shaped tube, one arm of which goes into the container 3 while the other projects into the bottles 1 and 2 respectively to a point 10 one or two centimetres from the bottom. An aperture 11 is provided in each tube 9 beneath the bottle stopper and above the maximum level reached by the sample of fluid. The auxiliary fluid initially filling each bottle is sucked out, through a separate other pipe 12 passing through the bottom stopper, by a peristaltic pump 13, of the type in which flexible pipes are squeezed, for instance, with an adjustable uniform flow-rate. Each bottle is connected to a three-way electro-valve 14, one outlet leading to the pump 13, the second to the respective sample bottle, and the third allowing the pressure inside the bottle to be regulated to match the pressure prevailing above the fluid to be sampled, namely atmospheric pressure in the case of open-air channels.

Each electro-valve 14 is connected to a central control device 15, comprising an electronic clock 16 and means for selecting the sampling program 17.

The suction pump 13 is controlled by a mechanism 18, which subordinates it to the readings of a flowmeter 19, placed in the channel close to the sampling point 5. In this way, the rate of sampling is kept proportional to the flow-rate in the channel.

FIG. 2 represents part of the same apparatus seen from above, showing one half of a base containing twelve positions for bottles (e.g. 1), the central container 3, pipe 12 to suck out the auxiliary fluid, and three-way electro-valve 14.

Each of the bottles are enclosed in a casing (not shown) containing a heat-insulating material such as glass wool, so that if a refrigerating device is added, the temperature of the samples can be kept at 2° or 4°C, which is essential for the biological protection and analysis of the samples.

If a number of bottles of the same sample are needed, another type of apparatus can be used, comprising groups of bottles, each group containing the number of bottles required for a sample. Each bottle in these groups has its own siphon tube and suction pipe connected to an electro-valve, and the electro-valves for each group are operated simultaneously, in accordance with a program selected at the central control point.

The apparatus operates as follows.

Bottles and pipes are placed in position, and the three-way electro-valves are adjusted to place the inside of each bottle in communication with the space above the channel of fluid to be sampled; in other words, if sampling takes place in the open air, and air is used as the auxiliary fluid in the bottles, the bottles and pipes will be at atmospheric pressure.

Another auxiliary fluid may be selected such as an inert gas or liquid of lower density than the fluid to be sampled, and which will not mix with it.

When the control system has been regulated to ensure the appropriate frequency of sampling, the sampling operation begins. The electro-valve for bottle n°